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Washington, D. C.

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JOSEPH PRIESTLEY AS AN HISTORIAN OF SCIENCE, WITH SOME ACCOUNT OF HIS PHILOSOPHICAL APPARATUS EXISTING AT THE PRESENT TIME*

C. A. Browne, Chief, Bureau of Chemistry, Washington, D. C.

Joseph Priestley is in many ways a most interesting figure to students of the history of science. He was not only himself a most eminent natural philosopher, but he was also an ardent student of the history of science, to which subject he made numerous contributions. It is worthy of note that Priestley's earliest scientific book was his "History and Present State of Electricity" which he published in 1767 at the age of thirty-four. The success of this work induced Priestley to form the idea of writing histories upon all the branches of experimental science, and in the continuance of this plan he published in 1772 his "History of Discoveries Relating to Vision, Light and Colours" in two quarto volumes. The expense and labor connected with the publication of this second work caused Priestley to suspend further efforts upon additional histories of science until he had determined the state of public opinion as to works of this kind.

> The pleasure I have in this undertaking (he writes), is not so great but that it will depend upon the reception my labors meet with, whether I continue them or not. If those persons for whose opinion I have an esteem favor me with their approbation and the sale of the work indemnify me for the very great expenses I have been at on account of it, I shall persevere with pleasure. If the reception be unfavorable in these respects I shall certainly desist, and be thankful that I can betake myself to other studies not less agreeable to me.

The expense of putting out the "History of Discoveries Relating to Vision, Light and Colours" was so great that Priestley felt it necessary for purposes of protection to publish it by subscription. The list of subscribers contains 500 names including such celebrities as Jeremiah Bentham, Edmund Burke, Henry Cavendish, John Ingenhousz, Joshua Reynolds and Benjamin Franklin, the latter setting his name down to the generous extent of twenty copies. Franklin, as we know, gave Priestley the fullest support and encouragement in his historical and scientific investigations. His friendship had a great influence upon Priestley's work as a political and scientific writer. According to Sir T. E. Thorpe, "it may be truthfully said that Franklin made Priestley into a man of science."

Many of the subscriptions to the "History of Discoveries Relating to Vision, Light and Colours" were never paid and this fact together with the poor sale of the book caused Priestley to abandon his plan of writing other works upon the history of the sciences, although he had purchased a great number of books for this purpose. While this abandonment of his original plan was a great loss to the history of science, his preliminary studies in this field were the cause of his applying himself henceforth wholly to original research and the brilliancy of his accomplishments as an experimenter causes no one to regret that circumstances obliged him to make the change.

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* Paper read before the History of Science Society at the Philadelphia meeting of the American Association for the Advancement of Science, Dec. 29, 1926.

Priestley expressed clearer and more definite ideas upon the importance of studying science from the historic viewpoint than any previous writer. In many ways he may be regarded as the founder of this department of knowledge and some of the views which he expressed upon the subject deserve to be quoted.

> Let histories be written (observes Priestley) of all that has been done in every particular branch of science and let the whole be seen at one view. And when once the entire progress, and present state of every science shall be fully and fairly exhibited, I doubt not but we shall see a new and capital era commence in the history of all the sciences. Such an easy, full, and comprehensive view of what has been done hitherto could not fail to give new life to philosophical inquiries. It would suggest an infinity of new experiments, and would undoubtedly greatly accelerate the progress of knowledge; which is at present retarded, as it were, by its own weight, and the mutual entanglement of its several parts.[1]
>
> ....
>
> These histories are evidently much more necessary in an advanced state of science, than in the infancy of it. At present philosophical discoveries are so many and the accounts of them are so dispersed, that it is not in the power of any man to come at the knowledge of all that has been done, as a foundation for his own inquiries. And this circumstance appears to me to have very much retarded the progress of discoveries.[2]
>
> ....
>
> To whatever height we have arrived in natural science, our beginnings were very low, and our advances have been exceeding gradual. And to look down from the eminence, and to see, and compare all those gradual advances in the ascent, cannot but give the greatest pleasure to those who are seated on the eminence, and who feel all the advantages of their elevated situation. And considering that we ourselves are, by no means, at the top of human science; that the mountain still ascends beyond our sight, and that we are, in fact, not much above the foot of it, a view of the manner in which the ascent has been made cannot but animate us in our attempts to advance still higher, and suggest methods and expedients to assist us in our further progress.[3]
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> ....
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> The history of experimental philosophy, in the manner in which it ought to be written, to be of much use, would be an immense work; perhaps more than any one man ought to undertake; but it were much to be wished, that persons who have leisure, and sufficient abilities, would undertake it in separate parts.[4]

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[1] "Preface, History and Present State of Electricity," London, 1767, p. XV.

[2] "Preface, History and Present State of Electricity," London, 1767, p. VI.

[3] "Preface, History and Present State of Electricity," London, 1767, p. V.

[4] "Preface, History and Present State of Electricity," London, 1767, p. VII.

> In order to facilitate the advancement of all the branches of useful science, two things seem to be principally requisite. The first is an historical account of their rise, progress and present state; and the second, an easy channel of communication for all new discoveries. Without the former of these helps, a person, every way qualified for extending the bounds of science, labors under great disadvantages; wanting the lights which have been struck out by others and perpetually running the risk of losing his labor, and finding himself anticipated in the discoveries he makes, which is a great mortification and discouragement. In other respects, also, the progress of natural knowledge is retarded on this account; so that, in the present state of science, such histories as these are, in a manner, absolutely necessary.
>
> Considering how very few persons are acquainted with the present bounds of any branch of science, or, indeed, are in circumstances in which it is possible for them to acquire that knowledge, and how much time and labor are even, in that case, necessary, in order to acquire it; it must be allowed that, were those histories judiciously compiled, real discoveries would be much more numerous; and were these again easily and expeditiously circulated, the progress of knowledge might be accelerated beyond what we can now conceive.[5]

It will be interesting to turn from these general observations of Priestley upon the needs, purposes, and rewards of historical scientific studies to a personal account of his own methods as an historian of science.

> I have adopted (he writes), the historical method because it appears to me to have many obvious advantages over any other for my purpose; being particularly calculated to engage the attention and to communicate knowledge with the greatest ease, certainty and pleasure. Moreover, the recital of the labors of philosophers in an historical method gives a writer a better opportunity than a systematical method would do, of transmitting them to posterity in such a manner as will operate most powerfully on the minds of the readers and be a motive with them to exert and distinguish themselves in philosophical pursuits. To such considerations as these the mind of man is never wholly insensible.
>
> It will, however, be found, that, though the method I have chosen be historical, it is, at the same time, sufficiently systematical; and, indeed, pretty strictly so with respect to each distinct article in the several periods into which the work is divided; so that any person, if he choose it, may see, without interruption, all the discoveries that have been made relating to any single head or division of every subject. In order to be more systematical, and thereby to make the work more useful to young students, I have imitated the conduct of the best civil historians in making the order of time give place, with respect to many articles, to more natural, and therefore more important connections. Thus, when later writers have added but little to the observations of those who preceded them, I have given the whole of a subject in an earlier period, and when former writers contain very little, I have given the whole in a later period. This method cannot but be more agreeable to all my readers than a mere journal, or a strictly chronological narrative of transactions.[6]
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> ....
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> At the close of each part of the history, I shall endeavor to give a comprehensive view of all the discoveries which have been made in that branch of science to which it is ap-

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[5] "Preface, History and Present State of Discoveries Relating to Vision, Light and Colours," London, **1772**, p. I.

[6] "Preface, History and Present State of Discoveries Relating to Vision, Light and Colours," London, **1772**, p. VII.

> propriated, pointing out their natural connection, noting what I shall imagine to be the principal desiderata, and giving hints for the extension of it. To each volume I shall also subjoin an explanation of all the technical terms that occur in it; and, in order to give a clearer view of the progress of the science, I shall, whenever it can be done conveniently, exhibit a view of all those persons who have made the greatest figure in the history, after the manner of my *Chart of Biography*.[7]
>
> ....
>
> Every new fact, or important circumstance, I have noted as it arose; but I have abridged all long details, and have carefully avoided all digressions and repetitions. For this purpose, I have carefully perused every original author, to which I could have recourse; and every quotation in the margin points to the authority that I myself consulted, and from which the account in the text was actually taken. Where I could not procure the original authors, I was obliged to quote them at second hand, but the reference will always show where that has been done. That I might not misrepresent any writer, I have generally given the reader his own words, or the plainest translation I could make of them; and this I have done, not only in direct quotations, but where, by a change of person, I have made the language my own.
>
> I have made it a rule to myself, and I think I have constantly adhered to it, to take no notice of the mistakes, misapprehensions and altercations of electricians; except so far as, I apprehended, a knowledge of them might be useful to their successors. All the disputes which have no way contributed to the discovery of truth, I would gladly consign to eternal oblivion. Did it depend upon me, it should never be known to posterity, that there had ever been any such thing as envy, jealousy, or cavilling among the admirers of my favorite study. I have, as far as my best judgment could direct me, been just to the merits of all persons concerned. If any have made unjust claims by arrogating to themselves the discoveries of others, I have silently restored them to the right owner and generally without so much as giving a hint that any injustice had ever been committed. If I have, in any case, given a hint, I hope it will be thought, by the offending parties themselves, to be a very gentle one; and that it will be a *memento* which will not be without its use.[8]

It will be seen from these quotations how thoroughly Priestley, in his pioneer work, had reflected upon the duties of the historian of science and how modern his views appear in many of their present-day applications.

Priestley's life and work have an especial interest to American scientists, for after his exile from England the last ten years of his life from 1794 to 1804 were passed at Northumberland, Pennsylvania. The house which he built at the junction of the two branches of the Susquehanna River is still in perfect preservation and was dedicated on the fifth of last September as a permanent memorial. Close to this house there has been erected, by the liberality of certain alumni of the Pennsylvania State College, a fireproof museum for containing manuscripts, books, apparatus and other memorabilia of the famous scientist. In addition to the collection at Northumberland, many pieces of the existing apparatus from Priestley's Northumberland laboratory are deposited at Dickinson College, Pennsylvania, and at the Smithsonian Museum in Washington. It is to the history and present condition of some of this apparatus that I wish to devote the remaining portion of this paper.

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[7] "Preface, History and Present State of Discoveries Relating to Vision, Light and Colours," London, **1772,** p. VIII.

[8] "Preface, History and Present State of Electricity," London, **1767,** p. IX.

Priestley's interest in science, as may be inferred from his writings, was not confined to chemistry alone, but was of a much more general character and embraced electricity, optics, meteorology, physics, astronomy, surveying, and navigation. This wide range of Priestley's scientific interests is reflected in the character of the apparatus which he used in his experiments. In an inventory of Priestley's property which was destroyed by the rioters at Birmingham in 1791, there is noted under Section 5 the following heading, "A Schedule Inventory and Appraisement of the Philosophical Instruments, Electrical Apparatus, Optical Instruments, Mathematical Instruments, Chymical Apparatus and Chymical Substances Belonging to the said Plaintiff being in and about his said Dwelling House and Outhouses and being wholly or in part destroyed and demolished by the Rioters."[9]

There are mentioned in this inventory thermometers, barometers, hygrometers, air pumps, magnets, electrical machines, microscopes, telescopes, compasses, globes, an orrery, a magic lantern, a theodolite, a sector, a pyrometer, burning lenses, balances, furnaces, retorts, flasks, crucibles, bell jars, eudiometers and other miscellaneous apparatus to the total value of 605 pounds and 2 shillings. It is fortunate that so complete and detailed a list of the apparatus in Priestley's Birmingham laboratory has been preserved. Many of the instruments in the inventory had been given to Priestley by his numerous friends and admirers who were equally zealous in helping him at his new home in Hackney to replace the apparatus which was destroyed by the rioters in Birmingham.

Priestley's laboratory consisted of a small one-story building that was attached to his residence as a wing and it was here that he placed the extensive collection of apparatus which he brought from England. One wonders in contemplating the existing remnants of this equipment at the immense labor which must have been spent in transporting over rough trails so many pieces of large and fragile apparatus into the heart of what was then a wilderness. Unfortunately, there is no inventory of this Northumberland apparatus such as exists for Priestley's Birmingham laboratory. We know, however, that the Northumberland laboratory was equipped along the same broad scientific lines as the Birmingham laboratory; indeed, the existing evidence indicates that it was virtually a replica of the latter.

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[9] A complete inventory of Priestley's Birmingham laboratory is published on pages 221–234 of H. C. Bolton's, "Scientific Correspondence of Joseph Priestley," New York, 1892.

After Priestley's death in 1804 his laboratory and apparatus seem to have been left for a number of years in their original condition. Doctor Thomas Cooper, an English liberal of broad education and considerable scientific ability who had followed Priestley to Northumberland, made use of the laboratory after its owner's death, and in 1811 performed a research there upon the production of potassium from caustic potash. In this same year Cooper accepted the professorship of chemistry in Dickinson College at Carlisle, Pennsylvania, and in entering upon his new duties negotiated with Priestley's son for the purchase of some of his father's scientific apparatus by the trustees of the college. The transaction is recorded in the minutes of the trustees of Dickinson College for December 17, 1811, in the following words:

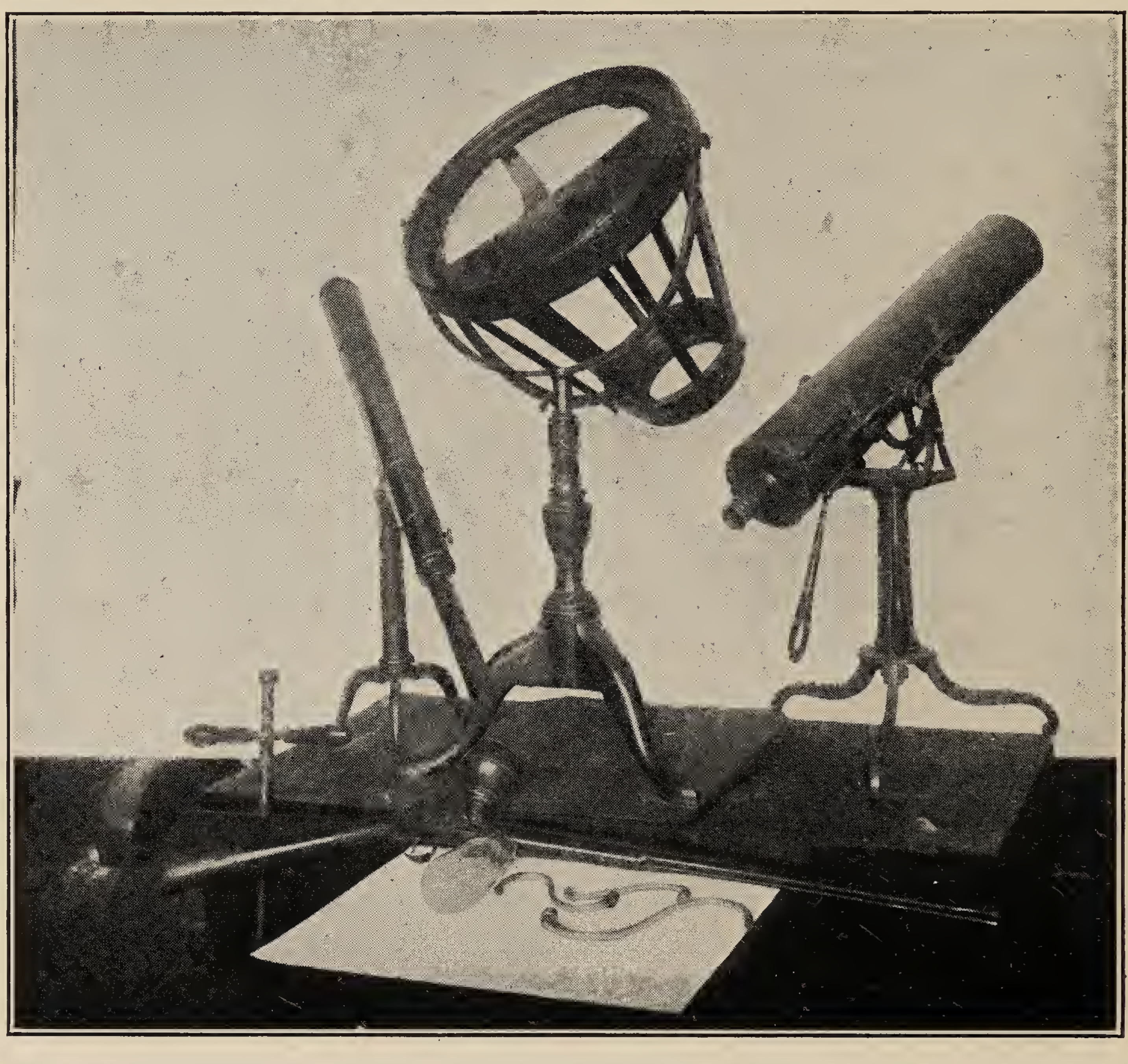

FIG. 1.—Some of the Priestley Apparatus in the Dickinson College Collection.

> Resolved that the Trustees will accept on the terms proposed by Mr. Priestley (son of the great Priestley) a three-foot reflecting telescope, five-inch reflector, mounted in the best manner, $220; a lense, $250, and air gun, $60, and that the amount be paid out

of the apparatus fund, and that Mr. Cooper be requested to inform Mr. Priestley of this resolution and that his draft will be duly honored.

The instruments which were thus purchased, together with other apparatus acquired by Doctor Cooper from the Priestley estate, are still preserved in the museum of Dickinson College. The collection is described in a little, illustrated pamphlet published by Doctor Charles F. Himes, professor in Dickinson College from 1865 to 1896.

The chief item of interest in the Dickinson College collection[10] (Fig. 1) is the large compound burning glass, composed of two lenses, the larger 16 and the smaller 7 inches in diameter. The heavy metal frame is pivoted on a stand which permits the adjustment of the glass to any position of the sun. This glass was used by Priestley as a source of heat in his chemical experiments and is similar to the one which was used by him in the classic experiment of 1774, when mercuric oxide, placed in the focus of the two lenses, was decomposed with the evolution of oxygen. This piece of apparatus was sold by Priestley's son to Dickinson for $250.00.

Priestley's air gun, acquired by Dickinson for $60, is also shown in the photograph of the Dickinson collection apparatus. It is a well-finished, beautiful instrument which fired a bullet weighing 45 grains. The air magazine consists of an iron globe $3^1/_2$ inches in diameter which can be unscrewed from the barrel of the gun and charged with air by attaching to a compressor, also shown in the illustration. The magazine, holding air enough for about twelve shots, is then rescrewed to the gun and fired by pressing the trigger which releases enough air for a single discharge. There is a tradition that Priestley hunted deer with this air-gun in the neighborhood of Northumberland. In the old days at Dickinson College the senior class had an annual target practice with Priestley's air-gun, but this custom has long been discontinued.

The reflecting telescope sold by Priestley's son to Dickinson for $220 (shown at the right in the photograph) is a handsome instrument and still in excellent condition. The reflecting mirror, 5 inches in diameter, is contained in a strong brass tube, $2^1/_2$ feet long, the whole being well mounted upon a brass tripod. This apparatus bears the name of the maker "W. & S. Jones, 135 Holburn, London."

Dickinson College also possesses a fine achromatic refracting telescope that belonged to Priestley. The instrument (shown at the left in the photograph) is 4 feet long and is important historically, as it was made by John Dollond, the first manufacturer to produce an achromatic lens.

According to Professor Himes, an orrery of Priestley was also acquired by Dickinson College. The instrument, however, was not in working condition and, undergoing a gradual disintegration in the course of years, has now completely disappeared.

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[10] We are indebted to President J. H. Morgan of Dickinson College for the photograph of the Priestley apparatus preserved at Carlisle, Pa.

The Dickinson collection of Priestley apparatus also contains a flask of heavy glass with ground openings adapted to fit the ground ends of various heavy, curved glass tubes. This flask and its tubular connections are similar to those described in Priestley's publications upon the gases.

The apparatus remaining in Northumberland, after the acquisition of the pieces by Dickinson College, continued in the possession of Priestley's descendants. Upon the return of Joseph Priestley, 2nd, to England, the apparatus and library of his father were entrusted to Dr. Thomas Cooper for sale, but it is uncertain what transactions were effected by him in this connection. The apparatus was probably stored in Northumberland but I have been unable to trace its history during this period. Joseph R. Priestley, the son of Joseph Priestley, 2nd, and grandson of the discoverer of oxygen, came to America at the age of 19 and took up his residence in Northumberland, where he acquired possession of his grandfather's relics. There is a family tradition that when he moved from

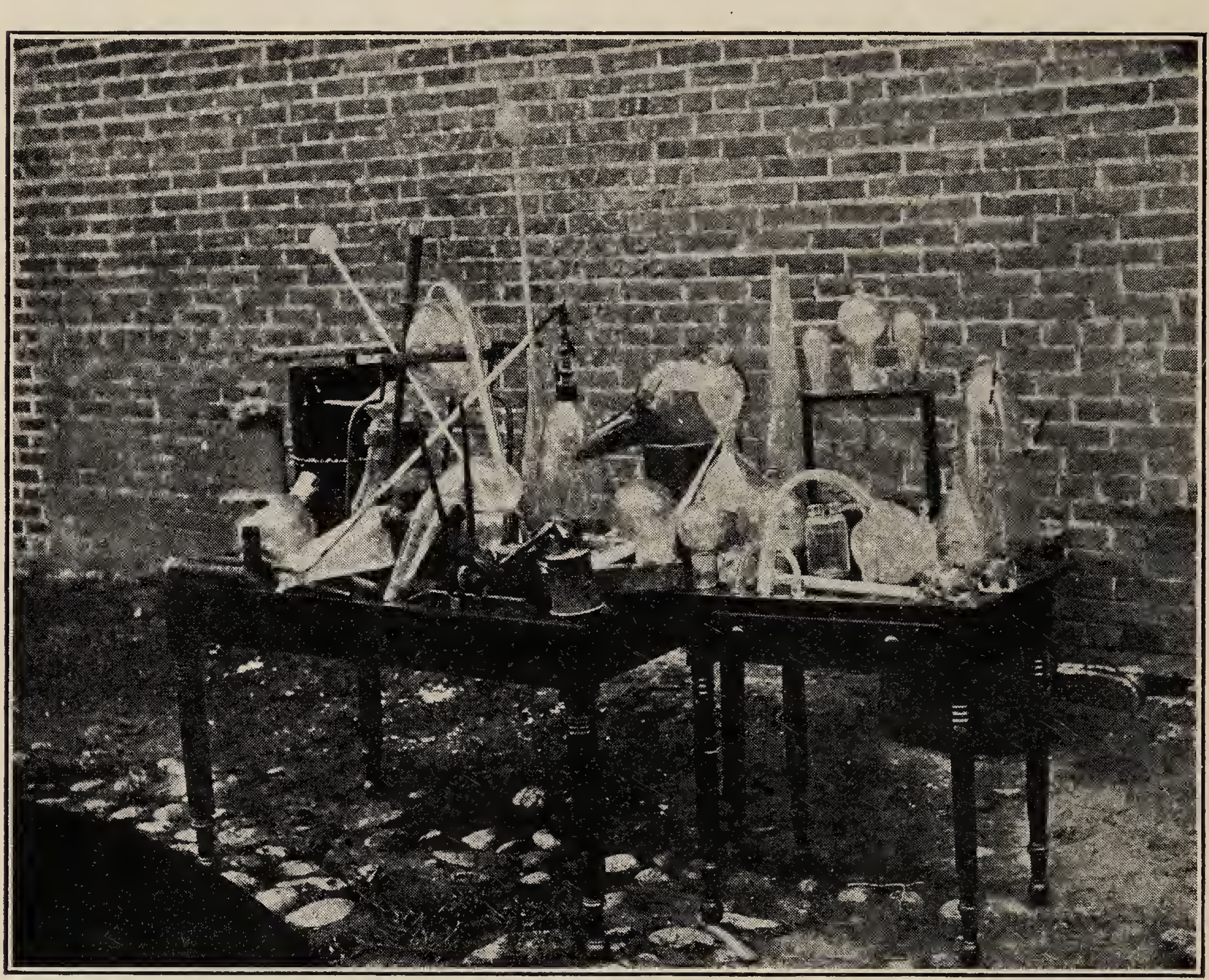

FIG. 2.—Chemical Apparatus of Dr. Joseph Priestley Exhibited at the Northumberland Anniversary on Aug. 1, 1874. Photograph by Prof. L. H. Laudy, Columbia College School of Mines.

his farm in Tuckahoe Valley to Northumberland, the horses ran away with the wagon in which some of the apparatus was packed and many valuable pieces were broken. When Joseph R. Priestley died in 1862, many of his grandfather's effects were sent to his sisters in England, but I have been unable to determine whether any apparatus was included in this shipment. The possessions of the great chemist that still remained after this division passed to Doctor Joseph Priestley, 4th, son of Joseph R. Priestley and great-grandson of the discoverer of oxygen.

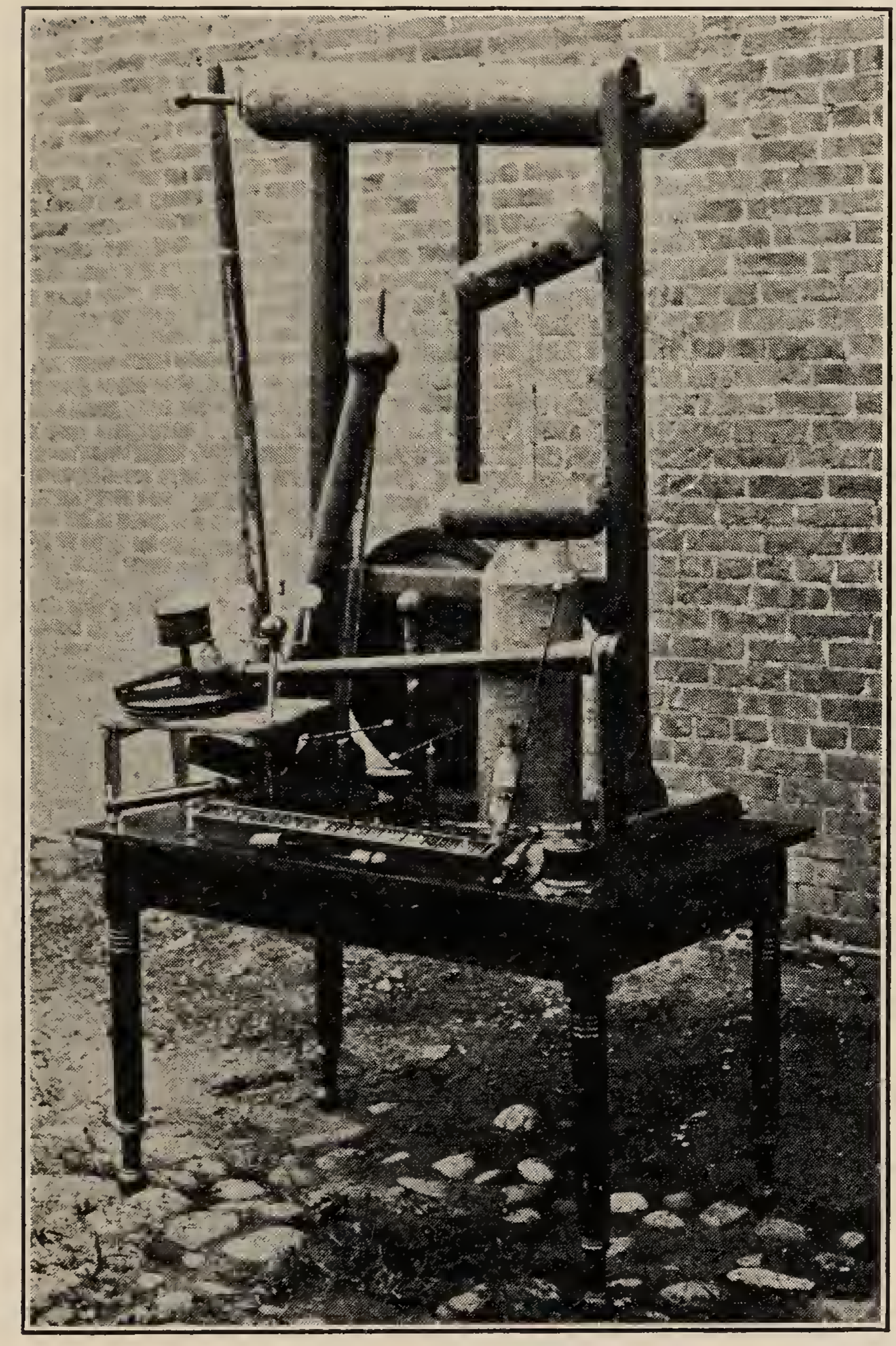

FIG. 3.—Electrical Apparatus of Dr. Joseph Priestley Exhibited at the Northumberland Anniversary on Aug. 1, 1874. Photograph by Prof. L. H. Laudy, Columbia College School of Mines.

On August 1, 1874, at the time of the celebration of the 100th anniversary of the discovery of oxygen by Priestley, the various pieces of his apparatus that still remained in Northumberland were photographed by Professor L. H. Laudy of the Columbia College School of Mines, and the collodion negatives which he made are still in existence in the Chandler Chemical Museum of Columbia University, in a perfect state of preservation. Three of the photographs here reproduced are recent prints from these old negatives.

The first (Fig. 2) shows two tables of chemical apparatus consisting of bell jars and connections, retorts, glass bottles, flasks, tubular connections, a balloon-shaped vessel of dark glass, parts of a laboratory furnace, crucible tongs, a large, metal tripod, a balance in a glass case, water baths, and various other utensils of uncertain character.

The second photograph (Fig. 3) shows a table of some of Priestley's electrical apparatus consisting of a large electrical machine with wheel in a wooden frame, an insulating stand with four glass legs, a large cylindrical insulator of wood for holding charged objects, a heavy glass rod attached to a metal cylinder which was probably used for generating static electricity by rubbing, an insulated electric jar, various insulated supports with rods and balls, metal holders with points for discharging electric sparks, and various other miscellaneous parts. This photograph also shows a long box of slides for microscopic observation.

The third photograph (Fig. 4) shows a collection of Priestley's optical and astronomical apparatus, consisting of two telescopes, several microscopes and microscopic attachments, a magic lantern with several lantern slides, several compass cases with cards, a globe, an orrery with the sun and five planets, a mounted frame containing the chart of a planetarium, and numerous miscellaneous small fittings of unknown character.

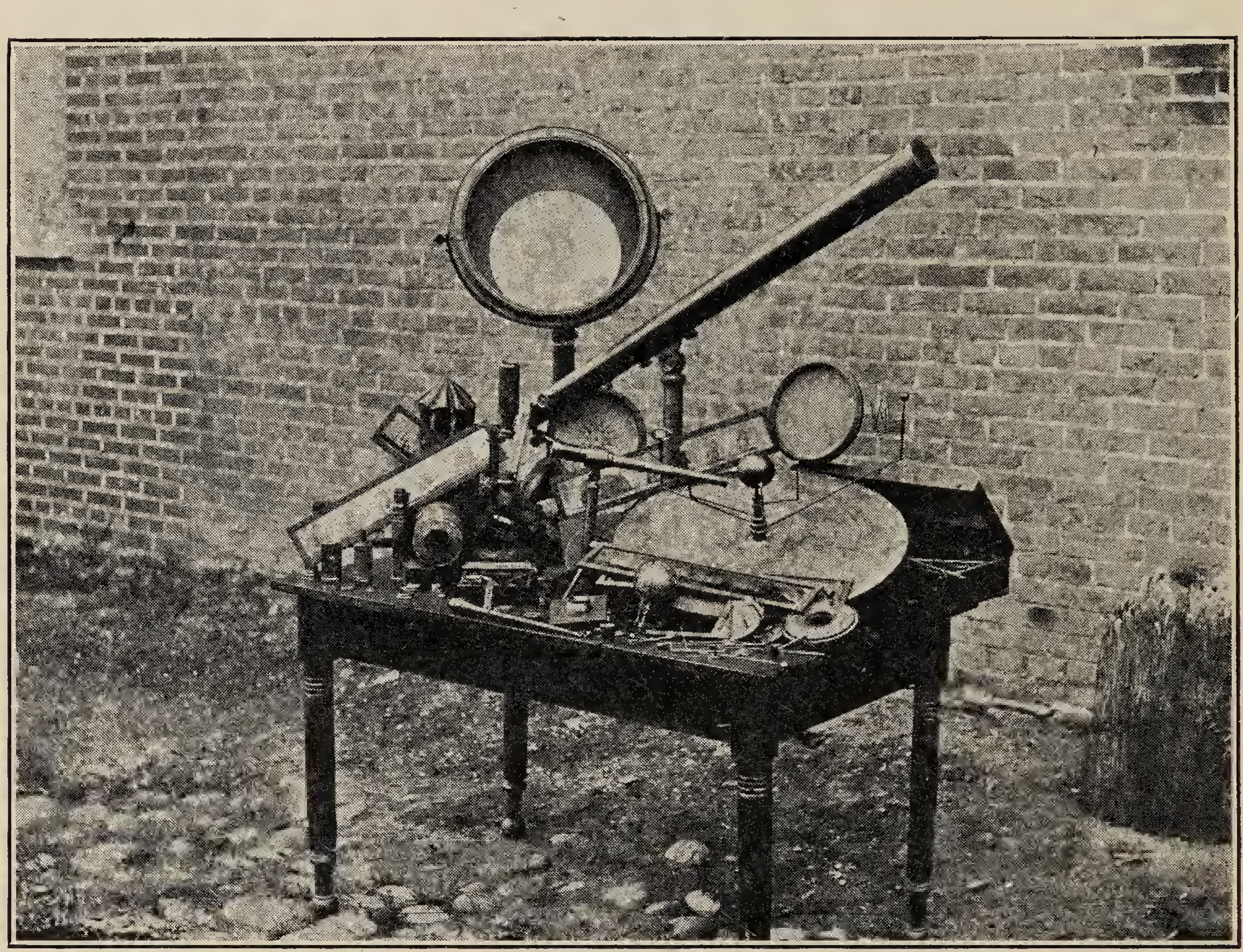

FIG. 4.—Optical, astronomical, and other philosophical apparatus of Dr. Joseph Priestley exhibited at the Northumberland Anniversary on Aug. 1, 1874. Photograph by Prof. L. H. Laudy, Columbia College School of Mines.

The scientific apparatus shown on these plates taken by Professor Laudy over fifty-two years ago is of the same general character as that listed in the Birmingham inventory of 1791, and shows that Priestley, in fitting up his Northumberland laboratory, followed, as was natural the original English plan of equipment. Various small minor pieces of

Priestley's apparatus were given to some of the chemists who attended the centennial meeting at Northumberland in 1874.

Shortly after the death of Doctor Joseph Priestley, 4th, at Northumberland in March, 1883, Doctor Spencer F. Baird, Secretary of the Smithsonian Institution, and a distant family connection, wrote to his widow as follows:

SMITHSONIAN INSTITUTION,
Washington, D. C., April 24, 1883.

Dear Madam:

It was with very great regret that I heard of the death of Dr. Joseph Priestley, appreciating not only the loss to his family but to the world at large. As a distant connection, I claim the right of personally expressing this same regret.

I would not venture to intrude upon you at present in a matter of business, but for the solicitation of eminent gentlemen who are extremely desirous that the philosophical apparatus in the possession of Dr. Priestley, and descended to him from his distinguished ancestor of the same name, should be held as one of the sacred relics in the history of American science. Concurring heartily with this desire, I now beg to say that if you will entrust this apparatus to the Smithsonian Institution, it will be accorded a prominent place in the historical department of the National Museum where it can be exhibited and appreciated in a thoroughly fireproof building. The National Museum is the finest edifice of this kind in America, and perhaps in the world, and has a considerable collection of precious articles in it. We have just had transferred to us the entire collection of Washington and Franklin articles formerly in the Patent Office; and are continually receiving similar articles, on account of the safe custody that we can assure. The philosophical and chemical apparatus, however, to which I have referred, will form part of a collection illustrating the evolution of chemical and physical science, so far as apparatus is concerned, and be a suitable introduction to a display of all the more modern devices for such investigations.

Yours truly,
(signed) SPENCER F. BAIRD,
Secretary S. I.

Mrs. Dr. Joseph Priestley,
Northumberland, Pa.

The surviving heirs expressed their willingness to this transfer and a large part of the scientific apparatus of the famous Priestley, which still remained in Northumberland, was sent to the Smithsonian Institution.

The inventory of the apparatus received by the Smithsonian Institution from Miss Priestley, Northumberland, Pa., on July 5, 1883, consisted of the following:

Acc. No. 13305, received July 5, 1883, from Miss Priestley, Northumberland, Pa.:

- Photograph of the statue of Priestley at Birmingham, England
- Brass reflector and stand
- Stand with pendulum
- Orrery with stand
- Glass globe
- Flask with green glass
- Alembic glass
- Alembic glass, large
- 5 bell jars

Compass box
Electrical apparatus
Galvanometer
Apparatus
Apparatus with Leyden jar
Leyden jar with brass lid
Box of tubing with parts of apparatus
Large collection of fragments of glass, iron and wooden apparatus

Of the apparatus deposited in the Smithsonian Institution by other Priestley heirs "a brass disc with glass handle for electrical experiments" was received on May 1, 1893, from Mrs. Dr. Thomas Lyon of Williamsport, Pa., and two large globes and stands were received on May 25, 1893, from Mrs. Eliza R. Lyon of Williamsport, Pa.

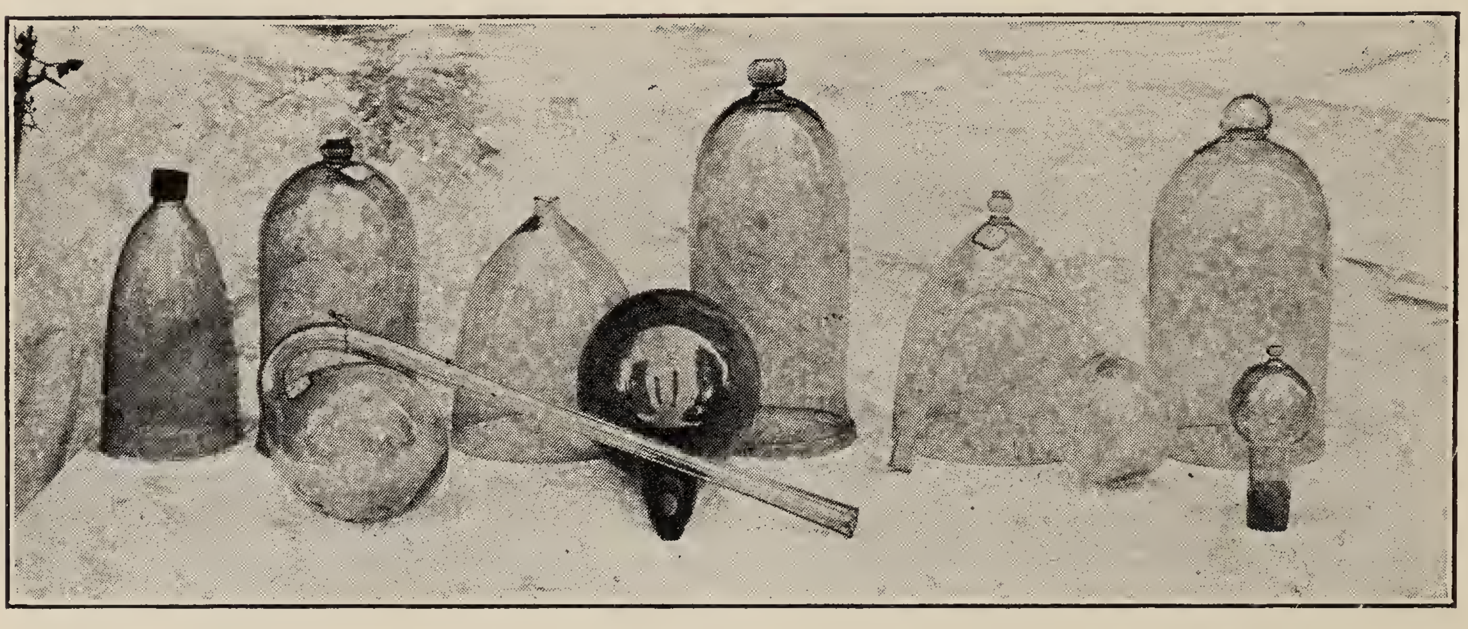

Fig. 5.—Bell-jars, retorts, and other glass apparatus of Dr. Joseph Priestley in the National Museum, Washington, D. C. Some of this apparatus is shown in Fig. 2.

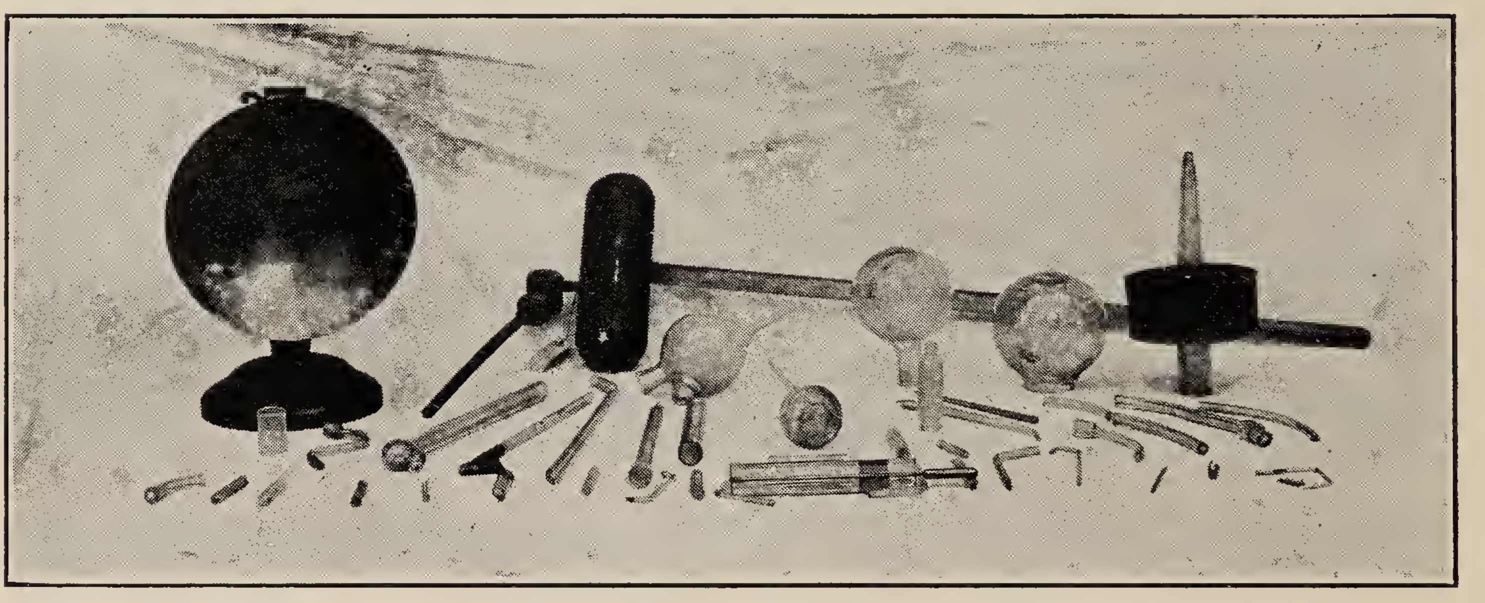

Fig. 6.—Various pieces of chemical and physical apparatus of Dr. Joseph Priestley in the National Museum, Washington, D. C. Some of those pieces are shown in Figs. 2 and 3.

With the kind permission of the Smithsonian Institution I have had photographs made of as many of the pieces of the Priestley apparatus as could be found and these are shown in Figs. 5, 6, and 7.

The first photograph (Fig. 5) shows six bell jars of various construction.

two retorts, a small globular receiver with wide neck and a balloon-shaped vessel of dark glass.

The second photograph (Fig. 6) shows various flasks and miscellaneous pieces of glass tubing, connections, etc.; a concave, copper reflector mounted upon a stand; a heavy glass rod attached to a metal cylinder which was perhaps used for generating static electricity; and various other utensils which were probably employed in electrical experiments.

The third photograph (Fig. 7) shows other apparatus of a miscellaneous electrical, mechanical, and astronomical character. There is a large cylindrical insulator of wood; an insulating stand shown in Fig. 3, but with two of the glass legs missing; an orrery (shown in Fig. 4 but now in a much greater state of deterioration); a compass card and case; the chart of a planatarium for the years 1752–1800, the year 1801 being written in with ink, very possibly by Priestley himself; and some forty small pieces of apparatus consisting of weights, balls, gears, thumb screws, and other miscellaneous fittings of an unknown character.

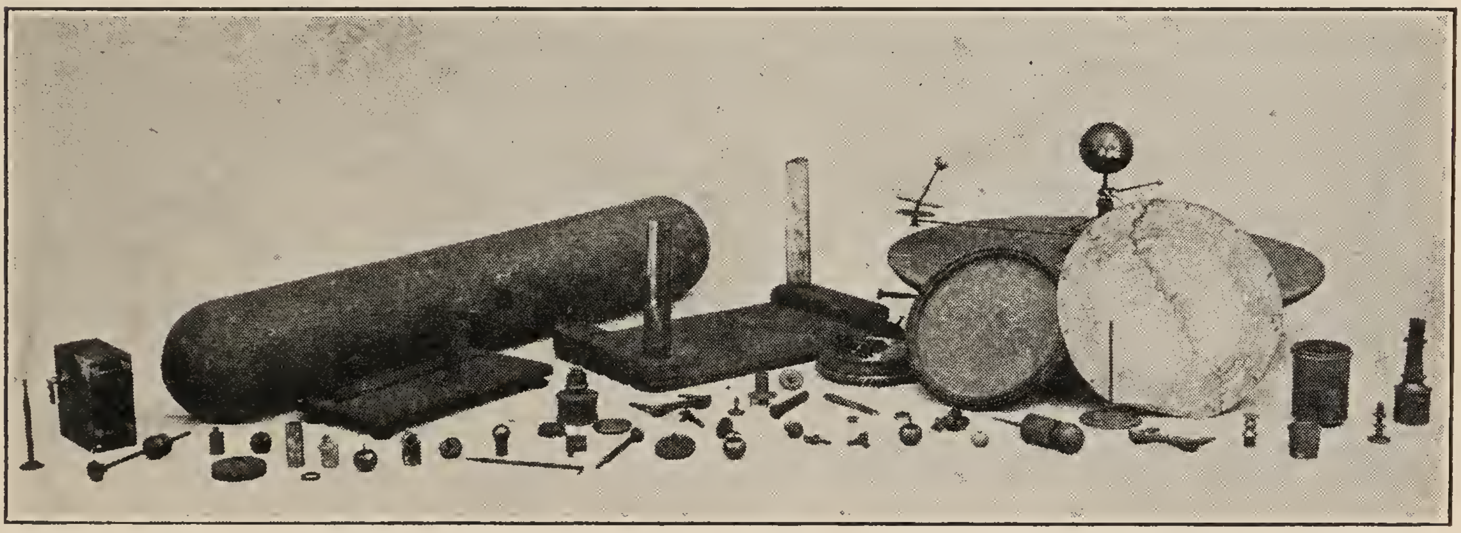

FIG. 7.—Various pieces of electrical, astronomical, and other philosophical apparatus of Dr. Joseph Priestley in the National Museum, Washington, D. C. Some of these pieces are shown in Figs. 3 and 4.

A large number of the pieces of apparatus shown in these photographs of the Priestley apparatus in the Smithsonian collection can be recognized in Professor Laudy's photographs which were taken at Northumberland in 1874. Some articles are missing which I have been unable to trace and there are some pieces in the Smithsonian collection, such as the copper reflector, which I have been unable to identify in the Northumberland photographs.

Owing to the lack of available space in the National Museum for adequately exhibiting the Priestley apparatus, the Smithsonian authorities have kindly consented to deposit all this material in the Priestley Museum at Northumberland as an indefinite loan. The Assistant Secretary, Dr. A. Wetmore, writes me in this connection as follows: "Until the

National Museum has more space for an exhibit of physical apparatus, it appears that these relics will find better use in the museum established for Priestley in his old home than stored here in the national collections." This decision of the Smithsonian authorities will, I am sure, meet with the hearty approval of all who are interested in the history of American science.

Not all of Priestley's philosophical apparatus remaining in Northumberland at the death of his great-grandson was transferred to the Smithsonian Institution. Some important pieces were retained by the heirs or afterwards given to friends of the family. The telescope, microscope, microscopic sections, magic lantern, and lantern slides, which are shown in Professor Laudy's pictures of 1874, were retained in Northumberland by Miss Annie Priestley, the great-great-granddaughter of Joseph Priestley. She died in 1922, the last of the Priestley name to live in Northumberland. The apparatus which she left at her death and Priestley's balance, which had previously been given to Professor Edgar F. Smith, were afterwards exhibited to the public in the John Harrison Laboratory of Philadelphia, under the auspices of the Priestley Club of the University of Pennsylvania. At this exhibition a lecture was given upon Joseph Priestley by his great admirer, Professor Smith, who has done more than any other American to help perpetuate the great name and fame of Priestley. Last September the apparatus shown at this exhibition was returned with many other memorabilia of Priestley to Northumberland to find a permanent home in the recently dedicated Priestley Museum.

It remains to mention one other important historic piece of apparatus and that is the large air pump which was brought by Doctor Priestley to the United States in 1794 and was in later years acquired by the Franklin Institute of Philadelphia where it is now exhibited (Fig. 8).[11] The pump is attached to the framework of a well-constructed table; the piston is driven by a ratchet operated by a gear and crank which are mounted upon two pillars at one end of the table. At the opposite end of the table is a large column which holds the platform for supporting the vessel to be exhausted. The air is removed from the vessel by a tube leading from the platform to the bottom of the pump cylinder underneath the table. A replica of this famous air pump of Doctor Priestley was exhibited at the recent Sesquicentennial Exposition in Philadelphia.

Such, in brief, is the history of the remaining fragments of the philosophical apparatus collected by Joseph Priestley at Northumberland between 1794 and 1804. In its time it was undoubtedly the most important general collection of the kind existing in the United States. From the instruments which remain of this magnificent equipment we can form

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[11] We are indebted to Mr. Howard McClenahan, Secretary of the Franklin Institute, for the photograph of Priestley's air pump.

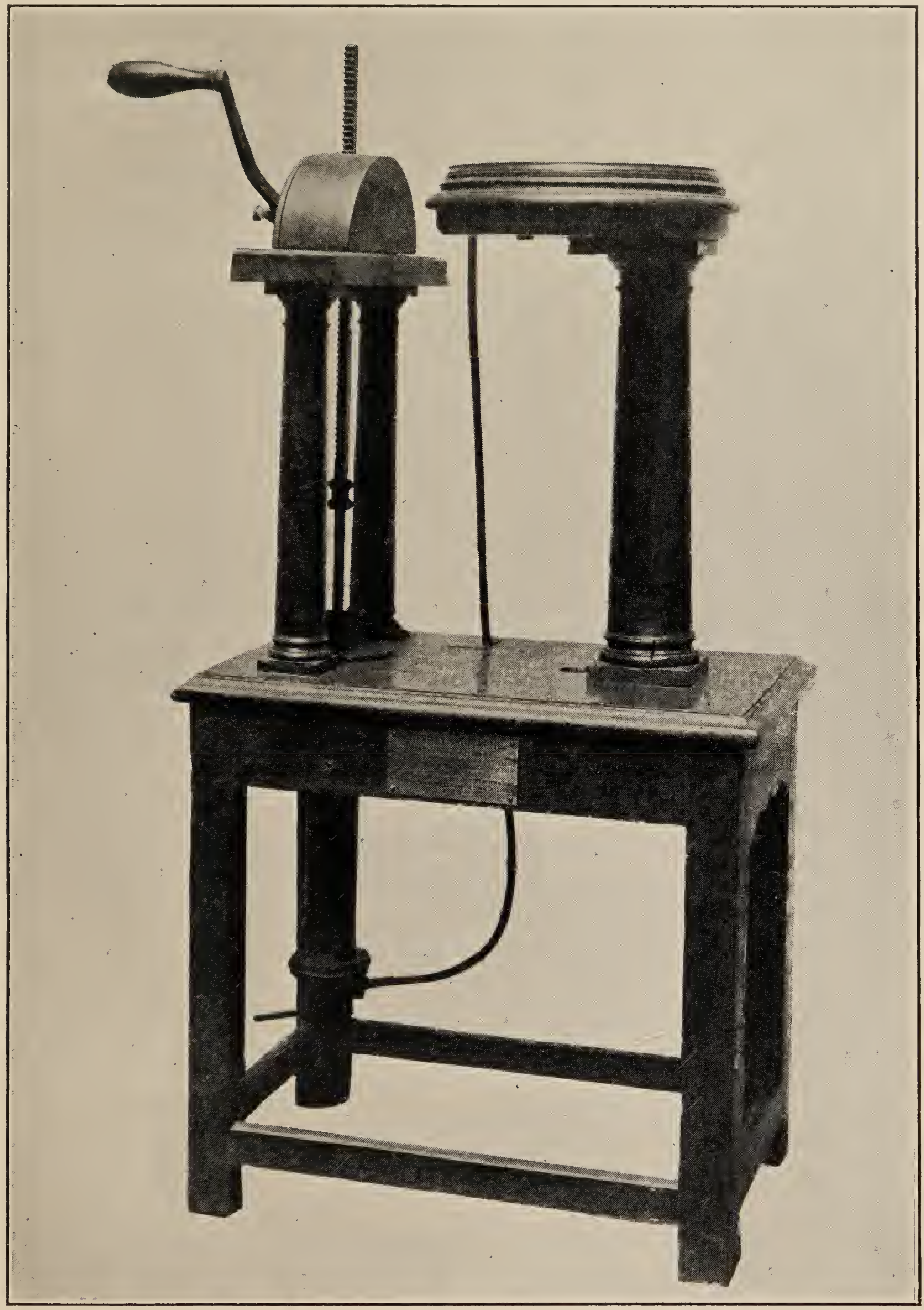

FIG. 8.—Priestley's Air-Pump. Presented about 1848 by Dr. Priestley's family to Charles Sellers. Reclaimed and preserved from destruction by Dr. Coleman Sellers. Presented to the Franklin Institute by the latter's sons, Messrs. Horace Wells and Coleman Sellers, Jr., 1920.

some idea of the great breadth of Priestley's scientific interests. To the student of Priestley's life and works a survey of this apparatus is only an additional confirmation of what Frederic Harrison terms "the immense range of his curiosity." This apparatus constitutes a great landmark in the history of science, not only in America but in the whole world. When we consider all that it has undergone with the vicissitudes of time, it is remarkable that so much of it has come down to us, and this has been due in no small measure to the excellent construction of the apparatus itself. In order that posterity may continue to share the benefit of this priceless inheritance, it is hoped that so far as possible all the existing apparatus which belonged to Priestley may eventually be restored to its old home at Northumberland.